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ABSTRACT

This report evaluates a project for secondary school education teachers in northeastern Texas. The objectives of the project were to: (1) train the secondary and middle school teachers of special education to use the Science Activities for the Visually Impaired/Science Enrichment for Learners with Physical Handicaps (SAVI/SELPH) curriculum; (2) provide those teachers with activities and lessons to implement the required science essential elements; (3) enable the special education teachers to meet the 40 percent laboratory requirement in science for grades 7-12; (4) provide safe and appropriate material and activities for science instruction; and (5) determine the effectiveness of the SAVI/SELPH program in meeting the needs of special education teachers and students in science instruction. After approximately seven days of training related to the science curriculum project, participants were tested for changes in attitude, knowledge and confidence. The 11 special co-op directors were also surveyed to evaluate the project. Evaluation materials and test scores are presented in the appendices. (Author/YP)

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SCIENCE FOR SECONDARY TEACHERS:

Implementing Lab Activities and Essential Elements in Special Education

A Paper Presented to:

Association of Teacher Educators
Mid-America Regional Conference

October 5, 1989

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ABSTRACT

Science for Secondary Teachers: Implementing Lab Activities and Essential Elements in Special Education, was sponsored by the Texas Higher Education Coordinating Board through a Title II, E.E.S.A. grant. This project was offered to secondary special education teachers in 11 counties of northeast Texas through East Texas State University at Texarkana in cooperation with the Region VIII Education Service Center. The objectives of the project were to: (1) train the secondary and middle school teachers of special education to use SAVI/SELPH science curriculum, (2) provide these teachers with activities and lessons to implement the required science essential elements, (3) enable the special education teachers to meet the 40% lab requirement in science for grades 7-12, (4) provide safe and appropriate material and activities for science instruction, and finally (5) determine the effectiveness of the SAVI/SELPH program in meeting the needs of special education teachers and students for science instruction. This project, in addition to addressing the previous 5 objectives, provided the participants with an opportunity to earn 3 semester hours of graduate credit through East Texas State University at Texarkana. The evaluation instruments, methodology, and findings will be discussed along with recommendations for successful implementation of the program.

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INTRODUCTION

The project "Science for Secondary Teachers: Implementing Lab Activities and Essential Elements in Special Education," was sponsored by the Texas Higher Education Coordinating Board through a Title II, E.E.S.A. grant. It was offered to secondary special education teachers in 11 counties of northeast Texas through East Texas State University at Texarkana in cooperation with the Region VIII Education Service Center. The intent of the project was to (1) train the secondary and middle school teachers of special education to use the SAVI (Science Activities for the Visually Impaired) / SELPH (Science Enrichment for Learners with Physical Handicaps) science curriculum, (2) provide these teachers with activities and lessons to implement the required science essential elements, (3) enable the special education teachers to meet the 40% lab requirement in science for grades 7-12, (4) concurrently provide safe and appropriate material and activities for science instruction, and finally (5) determine the effectiveness of the SAVI/SELPH program in meeting the needs of special education teachers and students for science instruction. This project, in addition to adressing the five objectives listed, provided the participants with an opportunity to earn three semester hours of graduate credit through East Texas State University at Texarkana.

One of the key features of this program is the SAVI/SELPH. SAVI was developed in the mid-1970s at the Lawrence Hall of Science at the University of California, Berkeley, in response to a need for science education materials for visually impaired students. In 1979, SAVI was expanded to "meet the needs of other handicapped students; the SELPH project emerged" (Malone, et al., 1984). In 1980

the Lawrence Hall of Science announced the establishment of the Center for Multisensory Learning (CML). Today, the CML "embraces all aspects of science education for disabled learners" and is "dedicated to the advancement of science for disabled students" (Malone, et al., 1984). The SAVI/SELPH program has these characteristics: (1) concrete experiences through manipulation of objects, (2) a multisensory approach to science, (3) flexibility, i.e., it can be used daily or on a monthly basis, and (4) a "science-based interdisciplinary program that is fun" (Malone, et al., 1984).

This project in East Texas provided the opportunity of training for 154 middle and secondary level special education teachers in 11 education co-ops that are located in the Region 8 Education Service Center catchment area (see Appendix A). These co-ops represent 47 Local Education Agencies (LEA's) and provide services to 261 teachers and 6,236 students in special education. Out of the 154 secondary special education teachers who were eligible for the training, 127 were chosen as participants by the co-op directors. In addition, this project provided one-half of the funding for a complete SAVI/SELPH kit for each of the 11 co-ops with the co-ops matching these funds. Thus, each co-op has all the materials necessary to continue the program after the initial training phase.

This project was designed to maximize teacher participation; thus all training and evaluation was conducted on-site in each of the 11 special education co-ops. There was an initial training session of 12 hours with 6 additional sessions of 6 hours each plus 3 hours of evaluation for a total of 51 hours of hands-on instruction and evaluation. The training sessions began in September of the 1987-88 school year

and terminated in May of 1988. All educational institutions involved cooperated by providing teacher release time for training.

EVALUATION INSTRUMENTS

Prior to formalizing the evaluation component, efforts were made to identify proper instruments to measure the project objectives and goals. In a conversation with Dr. Larry Malone of the CML, Berkeley, California, it was determined that two instruments that were being used by the Center for evaluation of SAVI/SELPH were available for use and could be modified to fit the specific needs of this project. These instruments measure cognitive gain and attitude toward science. After considerable thought it was determined that the instrument used by the CML at Berkeley to measure attitudes would not be as comprehensive as another attitude scale that was developed by Dr. Richard W. Moore (Moore, 1973). This instrument was used rather than the scale used at Berkeley for the following reasons. First, the Moore scale measured attitudes toward the teaching of elementary science and also attitude toward science. The scale used by the CML measured only attitude toward science. Thus, more useful information could be gathered using this instrument. Second, Dr. Moore had established the validity and reliability of the scale through a formal process, thereby reasonably insuring the resulting data to be accurate. The instrument used by the CML did not have validity or reliability established. In addition, an instrument to measure perceived levels of confidence that were related to the goals of the project was also utilized (see Appendix B). Later, a course evaluation form was administered to the participants that measured their

perceptions of the workshop in relation to the university goals of good teaching and course content (see Appendix D). Also, a survey form that also related to program goals was constructed to collect information directly from each co-op director (see Appendix C).

In addition to the instruments given to determine if the project was successful, background and biographical information about the participants was also collected.

EVALUATION METHODOLOGY

In September of 1987 all participants were administered the following instruments prior to beginning the workshops.

1. Attitude scale
2. Pre-test for workshop content
3. Pre-test for confidence levels

Background and biographical information was collected that established a profile of the participants with respect to:

1. age,
2. gender,
3. teaching grade level,
4. the perceived relationship of special education to other subjects,
5. highest degree earned,
6. years of teaching experience.

At the conclusion of the project the following instruments were administered to the participants:

1. attitude instrument,
2. Post-test for workshop content
3. Post-test of confidence levels

Further, after completion of the workshops a course evaluation was given to all

participants who were enrolled in the graduate course to satisfy the requirements of East Texas State University at Texarkana. Also, a survey form was administered to the 11 co-op directors in June of 1988 in order to further determine the effectiveness of this project. The data were gathered and analyzed. Out of the original 127 participants only 1 person did not complete the 51 hours of training. This individual moved out of the school district and was unable to continue with the project. Thus, there were a total of 126 participants who completed all of the pre-post evaluation instruments except the university course evaluation form. This was due to the fact that for a variety of reasons 109 participants were qualified or chose to receive 3 hours graduate credit for the 51 hours of work done during the school year. Because of the unique geographic location of this project, three of the participants are residents of Arkansas or Oklahoma but teach in Texas and the money allocated for participants to receive college credit was inadequate to pay for out-of-state tuition. There were six participants who could not qualify for admission to graduate school for a variety of reasons ranging from lack of an undergraduate degree to not meeting all of the university admissions standards. In addition, there were eight individuals who chose not to seek graduate credit because they already had graduate degrees and did not need the hours or because they did not want to do the extra work it would take to earn the credit.

BIOGRAPHICAL AND BACKGROUND CHARACTERISTICS OF THE PARTICIPANTS

The 126 participants in this project were surveyed in order to establish a description of the population with respect to age, gender, teaching level, earned

degrees, number of years teaching experience and perceived relation of their subject matter area of expertise to science or the humanities (see Appendix E). The results of that survey are summarized as follows: the largest group of participants were between the ages of 30 and 49 (39%) with the overwhelming number (86%) being female. The majority of the teachers (40%) stated their teaching level to be 9th through 12th with 35% indicating that they taught neither 7th through 8th or 9th through 12th grade levels. One person did not respond to this item. However, after talking with the participants over the period of the grant, it became clear that special education teachers do not see themselves as teaching a grade level or levels per se. Thus, many teachers felt that neither category was appropriate for them. Most of the teachers (49%) identified with science and mathematics rather than humanities or other fields. The number of teachers having earned Bachelor's degrees (54%) were about equal to those with Master's degrees (46%). The majority of the teachers (46%) had taught between 6 and 15 years. Thus, upon inspection of the data it is clear that this population of teachers appears to have no distinguishable characteristics that would make them different from the rest of the teacher population other than lacking a clear grade level identification which seems to be specific to special education teachers.

EVALUATION FINDINGS

The original objectives of the project were the guides by which the evaluation process was designed. Thus, the first objective was to train 154 eligible middle and secondary level special education teachers in the use of the SAVI/SELPH science

curriculum. Out of the 154 teachers there were 127 chosen to participate by their co-op directors which is 83% of the total population of targeted teachers.

Discussion

Approximately 7 school days were taken up with the training in the use of the SAVI/SELPH curriculum but there was no provision made in the grant to supplement the LEA's budget to hire substitute teachers in order to release the participating teachers. Thus there was an almost universal complaint that where several teachers were involved from a single district, a financial hardship resulted. In retrospect, it is amazing that as many teachers were able to attend the workshops as did. Thus, this objective is considered to have been met.

The 2nd, 3rd and 4th objectives, which were (1) to provide activities to teachers in order to implement the required essential elements, (2) to enable special education teachers to meet state required 40% lab requirements in science 7-12, and (3) to provide safe and appropriate science materials and activities for the special education students in the targeted 11 co-ops, were all met by successful completion of the training in the use of the SAVI/SELPH curriculum.

Discussion

Certain assumptions were made with respect to the SAVI/SELPH curriculum. First, it had been used successfully at the University of California at Berkeley's Lawrence Hall of Science for children with all disabilities as well as with nondisabled children. In a conversation with Dr. Larry Malone, who is the director of the CML, it was determined that success was defined as providing (1) quality

laboratory experiences, (2) safe experiences and (3) an enjoyable, fun and educationally sound experience for handicapped students.

Thus the assumption of our project was that successful completion of the 51 hours of training by the teachers involved would satisfy objectives 2, 3, and 4 of the project. Since the majority of targeted teachers participated with 99% of them completing the training, those objectives were considered met.

The 5th objective was to determine the effectiveness of the SAVI/SELPH program in meeting the needs of special education students and teachers for science instruction that were involved with this project. The underlying assumption of this objective is that if needs of teachers were met then the science instruction of the students would take place and, thus, meet their needs.

In order to address this objective, efforts were made to determine and compare the participants' attitude toward science and science teaching prior to and after the workshops. Also measured was the participatns' cognitive gain as a result of their participation in the workshops was measured. Any increase in participants' perceived confidence in completing certain tasks that reflected the goals of the workshop was also assessed. Also, each participating teacher who sought graduate credit was asked to complete a form that is utilized by East Texas State University-Texarkana to aid in the evaluation of teachers and the courses they teach. In addition to these four measures that were taken directly from the participating teachers to evaluate the program, the directors of the special education co-ops were surveyed in order to access their perceived effectiveness of the project.

Discussion

There were several ways that the success of the project was measured. The relation of attitude with respect to achievement is considered of prime importance to this project and is discussed here.

ATTITUDE

There are a number of definitions of attitude that may be cited as example of common usage of the term. English and English define attitude as:

> *An enduring learned predisposition to behave in a consistent way toward a given class of objects.* (1958)

Krech feels that attitudes are best defined as:

> *An enduring system of positive or negative evaluations, emotional feelings, and pro or con action tendencies with respect to a social object.* (1962)

Allport gives this definition of attitude:

> *A mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related.* (1954)

Katz and Stotland (1959) consider that attitudes have three major components. The information component forms the foundation on which the attitude is built. The affective component involves feelings, and it is this component which attitude scales attempt to measure. The third component, the action component, represents the extent to which the attitude has habits of action associated with it.

Achievement and Attitude

There have been a number of studies carried out dealing with attitude as it

relates to achievement. Neale, Gill and Tismer (1970) report significant positive correlations between attitude and achievement. Their findings are supported by Buckeye (1968), Young (1968), and Shatlein (1968). However, all of this research deals with attitude and achievement in the subject area of mathematics. Doty and Doty (1964) show that achievement appears to be related to a series of personality characteristics, one of which they define as attitude. They found a high positive correlation between grade point average and attitude toward the instructional mode. Frey, Shimabukuro and Woodruff (1967) found that as the attitude of the pupil became negative, there was a marked decline in achievement. In a study by Headlund and Neidt (1967) it is reported that attitude becomes more closely related to achievement during the period of instruction. Tobias (1969) reported that undergraduate college students' attitudes toward programmed and automated devices, and especially their attitudes toward traditional devices, were highly related to their actual achievement from an instruction program. Thus, persons with highly positive attitudes toward traditional devices, such as exercise books and workbooks, tend not to learn as much from new media, such as programmed instruction.

Contrary findings do exist. Jackson (1968) concluded that nearly all investigations of the matter have found no statistically significant relationship between attitudes toward school and school achievement. However, the studies reviewed by Jackson concentrated on measuring general satisfaction with school, while the previous studies measured attitude toward specific school subjects. Thus, while there is some difference in the literature, in general there would seem to exist

a positive correlation between attitude and academic achievement, at least in specific subject areas.

Pupil Achievement in Relation to Teacher Attitudes

There is conflicting research as reported in the literature on the effect of teacher attitude on pupil achievement. Pinetz (1963) and Cheikin (1967) report no significant relationship between teachers' attitude and the academic achievement of pupils. However, Mastin (1963) found that elementary teachers with a positive attitude toward their pupils and the subject matter being taught brought about a positive attitude in their pupils and enhanced their ability to acquire factual knowledge. Also, Tobias (1969) suggests that teacher attitudes are likely to affect pupil achievement. Further, O'Toole (1967) reports that in a field study using programmed mathematics textbooks, programmed materials without the teacher was found to be superior to programmed material used by the teacher with a negative attitude.

Summary

Although the literature fails to show a causal relationship between teacher attitude and pupil achievement, it does reveal that teacher attitude is significantly related to pupil attitude. This would suggest that positive teacher attitude is important in developing positive pupil attitude. The significance of this is seen from the research dealing with the relationship of achievement and attitude cited earlier.

In an effort to determine as accurately as possible attitude and degree of

change in attitude, the scale developed by Moore (1973) was used. This instrument has a reported reliability coefficient of .82 and is considered to have construct validity. The scale measures attitudes toward science which is designated as T-SCI and attitude toward the teaching of science is designated as T-TEA. The instrument was considered sufficient for this project after review of the literature and telephone discussions with Dr. Moore. The instrument was given to all 127 participants before the project began and again upon completion of the workshops to the remaining 126 participants. The results of comparing the pre and post attitude scales for the 126 participants who completed the training showed an increase in their attitude toward both science and the teaching of science. In an effort to further analyze, the data a random sample of 20 participants was taken and the scores of this random sample for the pre and post attitude scales was compared using a paired t-Test. The results show that in both cases, T-SCI and T-TEA, the increase in attitude was statistically significant with an extremely small chance of error (see Appendix F). Thus there appears to have been a significant positive change in participant attitude toward both science and the teaching of science over the course of the project.

KNOWLEDGE

The instrument used to measure knowledge was given to all participants at the beginning and again at the end of the workshop. This instrument, which is used by the CML, did not have a reported reliability but in talking with Dr. Larry Malone of the CML he felt that it measured the goals of the program very well. Also, it was determined by inspection that the items measured the major content

objectives of this project and thus are considered to have face validity and are sufficient to measure cognitive gain for the purposes of this evaluation.

Comparison of the pre and post scores for all 126 participants showed an increase in the mean scores. In order to make further inferences a comparison of the pre and post scores of the random sample were compared using a paired t-Test. The results gave a difference between the pre and post tests that was statistically significant with a very small chance of the results being in error (see Appendix G). Therefore, it would appear that the teachers have gained significantly in knowledge as a result of attending the workshops.

CONFIDENCE LEVELS

The instrument that measured participant confidence consisted of 20 statements that described levels of performance that related to the goals of this project. The participants were asked to respond to each statement in 1 of 5 different ways that described their level of confidence on being able to do what the statement described. The 5 levels of confidence were weighted from 1 to 5 with 5 being the most confident and all statements were weighted in the same way. A comparison of all 126 participant responses between the pre and post measures on all 20 items was done using a paired t-Test. The results of this comparison gave a statistically significant difference with an extremely small probability of error (see Appendix H). Thus, the participants, as a group, are considered to have gained in confidence with respect to science and the many facets of teaching science.

CO-OP DIRECTOR SURVEY

The eleven special co-op directors were surveyed to gather additional data for evaluation of this project. This instrument had 6 items that were to be completed by the directors. The items are given below along with the results of the survey for each item separately.

1. ***How effective has the training been in helping your teachers meet the 40% lab requirements and the science essential elements?***

1	2	3	4	5
Not Effective				*Very Effective*

The responses were computed to have a mean of 4.54. Thus, the directors felt that program was very effective with respect to this major objective of the project.

2. ***Describe briefly how your teachers are using the SAVI/SELPH science kits (e.g.: Is there evidence of use or are they not being used?).***

-All kits are being used.
-Teachers check out the kits from the materials center.
-The kits are being checked out and used.
-Kits have remained in the classroom.
-Some of our teachers are using them effectively, some are not.
-They fight over them.
-Additional lab ordered.
-Most kits have been checked out by the teachers and have been used in the classroom.
-The kits have been checked out to several teachers in schools in the co-op.
-Teachers have a sign-up chart on top of each kit, they sign up for the kit for a particular month -- then forward kit to the teacher who is next on list.

3. ***What changes have you seen in your teachers' attitudes toward teaching science as a result of the training?***

-Makes a difference - students enjoy class more and it also stimulates more interest.
-More positive and enthusiastic at teaching science -- much more meaningful to students.
-Teachers are more agreeable to teach science because they have hands-on materials.

-Requests for science related materials have increased.
-More confidence in implementing E.E.'s.
-Much improvement.
-Lab work can be done in resource room with simple equipment.
-There appears to be more interest in teaching science.
-They have a better understanding of what to do.
-The teachers who took the workshop have been very positive concerning their science programs.
-Much more enthusiastic.

4. ***Are your handicapped students receiving more science instruction, less science instruction, or about the same amount of science instruction as before the training?***

More _____ *Less* _____ *About the same* _____

There were 8 directors who indicated more science instruction since implementating the program and 3 who indicated the same amount of science instruction but the quality of the instruction had improved.

5. ***What kind of follow-up would you like to have next year? How often? (check all that apply and indicate frequency.)***

a) on-site technical assistance _____ *how often* _____

b) workshops at Region VIII _____ *how often* _____

c) workshops within your co-op _____ *how often* _____

d) other _____

All of the directors indicated they wanted on-site technical assistance at least twice a year.

6. ***Please make any additional comments regarding the science training:***

-Very good program, made it more interesting for teachers and students.
-This was excellent training. My teachers enjoyed it and felt that it was time well spent.
-Due to the distance between our districts, it was difficult to schedule teachers for sessions.
-The training was excellent!

-Adaptable to differing levels and correlates with other subject areas, simple to get materials ready to use.
-Those involved in the workshop felt that it was very good training.

The results of the survey of co-op directors indicated that they as a group considered the project to be successful in meeting the needs of their teachers. They also indicated that as a result of the project their students were receiving more science instructions or the same amount but better instruction. Most important is the wide use of the SAVI/SELPH kits by teachers. What can also be considered as significant was the positive response to additional training. All directors wanted additional training for their teachers. The only negative remark was in response to item 6, which asked for comments. One co-op indicated difficulty in scheduling teachers due to distances that their teachers had to travel.

COURSE EVALUATION

There were 109 participants who chose to complete additional requirements in order to receive 3 hours of graduate credit from East Texas State University at Texarkana. A requirement for all courses taught at the university is a course and teacher evaluation form which is to be completed by all persons who complete that course. Out of the 109 participant 2 individuals did not complete the course evaluation form in its entirety. Thus there were only 107 useable forms. The results of analyzing the forms are as follows:

The evaluation form consisted of 10 statements that reflected some of the ways teachers and courses can be described. Each statement was to be scored on a scale of 1 to 7 with 7 being very descriptive of the teacher and 1 being not at all

descriptive. There was also a place to indicate that the item did not apply or the individual did not know. The first 8 items were considered to be applicable to all of the persons responding to this form. Items 9 and 10 did not reflect good measures for success of this course because they dealt with comparing this course and instructor to other courses and instructors at ETSU-Texarkana. Due to the large geographic area served by this project many of the participants had never taken a course from the university. Thus, these 2 items were not used in this evaluation. While the instrument is designed to provide feedback to instructors and to be used as an administrative tool of the university it was also considered to be a reflection of the success of the project. All of the 8 items were scored by tabulating the results and determining a mean for each of the items. The 8 items are given below along with the mean of the 107 responses for each item.

1. Has command of the subject, presents material in an analytic way, contrasts various points of view, discusses current developments, and relates topics to other areas of knowledge. 6.3

2. Makes him/herself clear, states objectives, summarizes major points, presents material in an organized manner and provides emphasis as needed. 6.3

3. Is sensitive to the response of the class, encourages student participation, and welcomes questions and discussion in class. 6.4

4. Is available to and friendly towards students, willing to discuss course-related problems outside of class, and willing to help students individually. 6.4

5. Enjoys teaching, is enthusiastic about the subject, has self-confidence and makes the course interesting. 6.5

6. The requirements for the course were clearly identified, and student work was graded according to the announced standards and procedures. 6.4

7. Assignments and tests were graded and returned within a reasonable time. 6.5

8. The instructional format utilized in this course (lecture, group discussion, individual pacing, etc.) was appropriate for the subject matter. 6.5

The results of this evaluation indicate that the majority of teachers considered the instructors and course content, which in this case is the 51 hours of project workshops, to be most appropriate with respect to the evaluation item listed above. This is considered another indicator that the project was a success.

SUMMARY AND RECOMMENDATIONS

This project has been successful in meeting the objectives that it sought to address. By all indications the majority of secondary level special education teachers in the targeted population were successfully trained in the use of the SAVI/SELPH Science Curriculum. This training provided the activities and lessons necessary for those teachers to implement the required essential elements and enabled the eleven co-ops to meet the state mandated 40% lab requirement in science for grades 7-12. These requirements were met while providing safe and appropriate science materials for the 47 LEA's in the 11 co-ops that this project served. The effectiveness of the training as measured by all of the evaluation instruments, including knowledge gained, indicates that the program was highly successful in meeting the needs of special education students and teachers for science instruction.

However, it is clear there were areas that should be modified if this program is to be used as a model for training special education teachers in the use of the SAVI/SELPH Curriculum:

1. Funds should be allocated to assist the LEA's in providing for substitute teachers.

2. The number of workshops provided by a single trainer should be reduced to a number that is more manageable not only in terms of clock hours but also in terms of geographic distances.

3. There should be a provision for follow-up measures that will allow for in-classroom assistance and evaluation of the project.

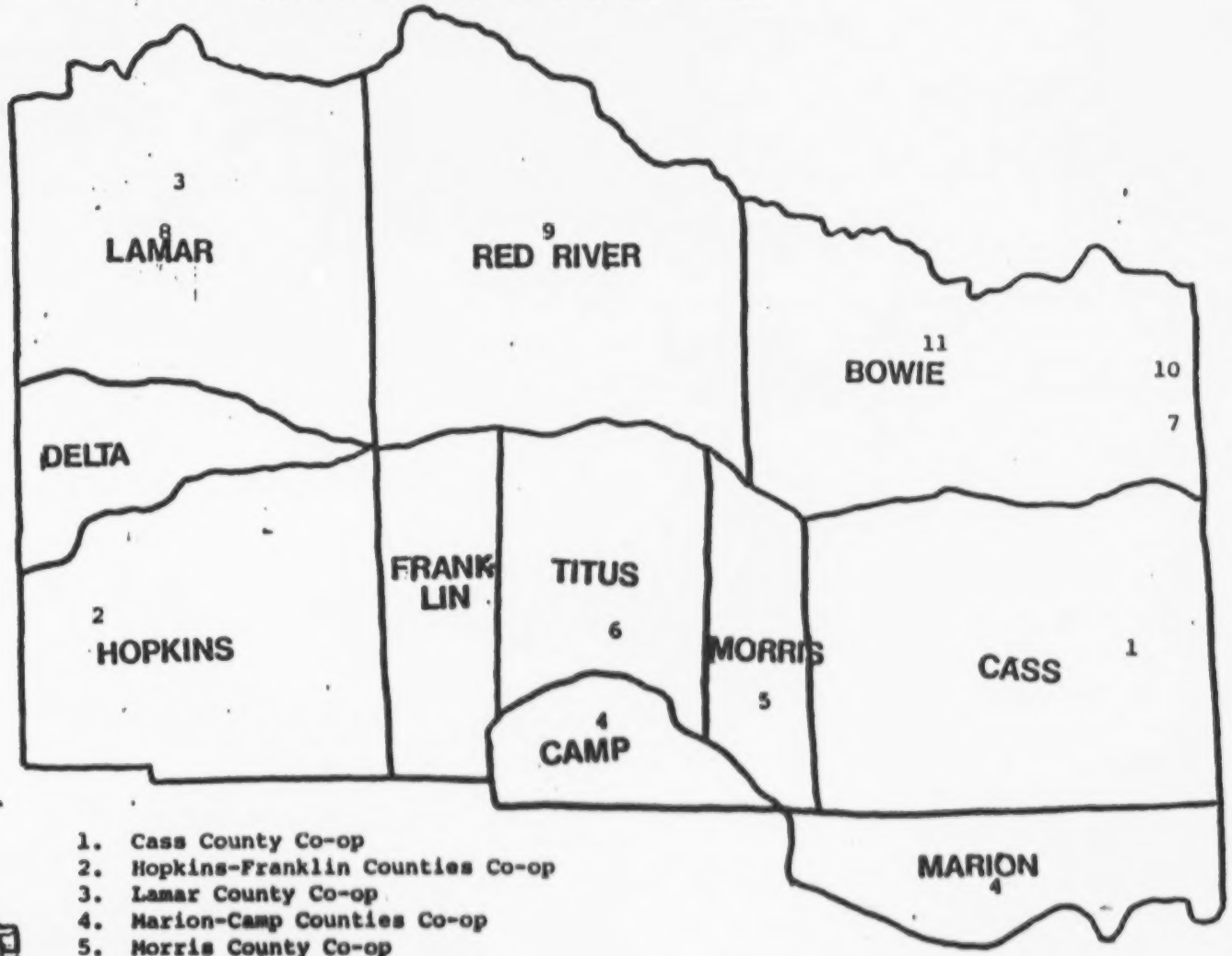
4. In order to provide a complete picture of the impact of this program it is recommended that participants and their students be compared with similar control groups on all evaluation measures.

In summary this program has demonstrated that the SAVI/SELPH Curriculum provides a means by which secondary and middle special education teachers can offer science instruction to their students that will provide needed laboratory skills. In addition, this program has shown that with some modification it is very appropriate for dissemination.

Appendix A

SPECIAL EDUCATION CO-OPS IN THE REGION VIII SERVICE AREA

SPECIAL EDUCATION COOPS IN REGION VIII



1. Cass County Co-op
2. Hopkins-Franklin Counties Co-op
3. Lamar County Co-op
4. Marion-Camp Counties Co-op
5. Morris County Co-op
6. Titus County Co-op
7. Northeast Texas Tri-District Co-op
8. Paris ISD
9. Red River County Co-op
10. Texarkana-Pleasant Grove Co-op
11. Western Bowie County Co-op

Appendix B

WORKSHOP EVALUATION INSTRUMENTS

WORKSHOP EVALUATION

This evaluation contains three types of measures. All evaluation will be scored using the SCANTRON sheet each of you have, using a #2 pencil. Directions for responding to the evaluation instruments are given along with instruction from the evaluator. First, print the name of your special education co-operative in the space for name on the SCANTRON sheet. Second, write Special Ed/Science in the blank for subject. Third, write in today's date in the blank provided. Last, print your SS# in the blank for ID# and blacken in the appropriate boxes. When you have finished, you may proceed.

WHAT IS YOUR ATTITUDE TOWARD SCIENCE AND SCIENCE TEACHING

There are some statements about science and science teaching on the next few pages. Some statements are about a person's feeling about science. Some of these statements describe views about how science should be taught. You may agree with some of the statements and you may disagree with others. That is exactly what you are asked to do. By doing this, you will show your attitudes toward science and science teaching.

After you have carefully read a statement, decide whether you agree or disagree with it. If you agree, decide whether you agree mildly or strongly. If you disagree, decide whether you disagree mildly or strongly. Then find the number of that statement on the answer sheet, and blacken the

A if you agree strongly.

B if you agree mildly.

C if you disagree mildly

D if you disagree strongly

Example:

00. I would like to have many friends.

00. A▬▬ B▬▬ C▬▬ D▬▬

(The person who marked this example agrees strongly with the statement, "I would like to have many friends.")

Please respond to each statement and blacken only <u>one</u> space for each statement.

Please do not make any marks on this test booklet.

1. What is your current age?

   A. 21-29
   B. 30-39
   C. 40-49
   D. 50 or over

2. What is your gender?

   A. Male
   B. Female

3. What is your teaching level?

   A. 7 through 8
   B. 9 through 12
   C. Other

4. Do you see your subject matter area as related more to science and mathematics or English and humanities?

   A. Science and Mathematics
   B. English and Humanities
   C. Neither

5. Highest degree earned?

   A. Bachelors
   B. Masters
   C. Doctorate

6. Number of years teaching experience?

   A. 0 to 5
   B. 6 to 15
   C. 16 to 24
   D. Over 24

7. It is important for children to learn that the air is approximately 20% oxygen -- at least by the sixth grade.

8. There is no need for the public to understand science in order for scientific progress to occur.

9. Most children should be able to design experiments - at least by the sixth grade.

10. Most people are not able to understand the work of science.

11. When something is explained well, there is no reason to look for another explanation.

12. A teacher should be a resource person rather than an information-giver in science.

13. The products of scientific work are mainly useful to scientists; they are not very useful to the average person.

14. I do not understand science, and I do not want to teach it.

15. A scientist must be imaginative in developing ideas which explain natural events.

16. After all is said and done, it is really the teacher who tells the children what they have to learn and know.

17. Some questions cannot be answered by science.

18. In teaching science, a teacher might spend more time listening to the children than talking to them.

19. Before one can do anything in science, he must study the writing of the great scientists.

20. Rapid progress in science requires public support.

21. Process skills are very important things to be developed in science.

22. Scientists believe that nothing is known to be true with absolute certainty.

23. A major purpose of science is to help man live more comfortably.

24. A new theory may be accepted when it can be shown to explain things as well as another theory.

25. Children must learn certain basic facts in elementary science so they can do well in science in junior high.

26. Scientists do not need public support; they can get along quite well without it.

27. I understand science and I want to teach it.

28. Every citizen should understand science because we are living in an age of science.

29. Children must be told what they are to learn if they are to make progress in science.

30. Science is so difficult that only highly trained scientists can understand it.

31. A teacher has a responsibility to teach the basic processes of science.

32. His senses are one of the most important tools a scientist has.

33. Science may be described as being primarily an idea-generating activity.

34. Ideas are one of the more important products of science.

35. As children experiment, a teacher may give helpful hints, but not the answer to a problem.

36. Science is pretty easy to understand.

37. The value of science lies in its theoretical products.

38. Process skills are the most important things to be developed by children in science.

39. A major purpose of science is to produce new drugs and save lives.

40. I like science, and I probably will be (am) a better science teacher than most other teachers.

41. Science is devoted to describing how things happen.

42. I am afraid to teach science because I can't do the experiments myself.

43. Public understanding of science is necessary because scientific research requires financial support through the government.

44. I just never will understand science.

45. People need to understand the nature of science because it has such a great affect upon their lives.

46. A teacher has a responsibility to teach the basic facts of science.

47. Scientists discover laws which tell us exactly what is going on in nature.

48. The idea of teaching science scares me.

49. Demonstrations should be used frequently so the children will understand what their teachers tell them.

50. Scientist believe that they can find explanations for what they observe by looking at natural phenomena.

51. Scientific laws cannot be changed.

52. If an experiment does not come out right, the teacher should tell the children the answer so they will not be lost.

53. There are some things which are known by science to be absolutely true.

54. It is a teacher's responsibility to tell children which things are important for them to know.

55. I do (will) not teach very much science.

56. An important purpose of science is to help men to live longer.

57. A useful scientific theory may not be entirely correct, but it is the best idea scientists have been able to think up.

58. Today's electric appliances are examples of the really valuable products of science.

59. It is important for children to learn how to control variables in an experiment -- at least by the sixth grade.

60. I am well-prepared to teach science.

61. The teacher should arrange things so that children spend more time experimenting than listening to her in science.

62. Scientists are always interested in improving their explanations of natural events.

63. The value of science lies in its usefulness in solving practical problems.

64. I think I understand the nature of science and science teaching pretty well.

65. Most people are able to understand the work of science.

66. Scientific explanations can be made only by scientists.

67. Most children should know that the blood carries oxygen to the cells -- at least by the sixth grade.

68. We can always get answers to our questions by asking a scientist.

69. Scientific laws have been proven beyond all possible doubt.

70. Looking at natural phenomena is a most important source of scientific information.

71. A major function of the teacher in teaching science is to help children identify problems.

72. If a scientist cannot answer a question, all he has to do is ask another scientist.

73. Anything we need to know can be found out through science.

74. It is important for children to know why iron rusts -- at least by the sixth grade.

75. Scientific ideas may be said to undergo a process of evolution in their development.

76. Scientists cannot always find answers to their questions.

CONTENT EVALUATION INSTRUMENT

This instrument is essentially a set of test questions over the primary content of the workshops. Please complete this section using the answer sheet provided.

There is only one best answer for each question. Please answer all of the questions and if you are in doubt as to the correct response, choose an answer that you think is best.

After you have carefully read the question choose the correct response. Then find the number of that question on the answer sheet and blacken the

A if it is correct.

B if it is correct.

C if it is correct.

D if it is correct.

E if it is correct.

Example:

The capital of Texas is:

A. Moscow
B. Ladonia
C. Austin
D. Texarkana
E. Lodi

A ▭▭▭ B ▭▭▭ C ▬▬ D ▭▭▭ E ▭▭▭

(The person who marked this example thinks Austin is the correct answer.)

77. Making quantitative observations best describes the process of:

A. classifying.
B. measuring.
C. inferring.
D. controlling variables.

78. A hypothesis is:

A. an educated guess based on evidence that can be tested.
B. a definition describing what you observe.
C. a set of data which can be used to find patterns of natural occurrences.
D. what you do to determine a result.

79. Which of the following statements is *not* true related to the scientific attitude?

A. Scientific investigations should be seen as being on a never ending continuum.
B. Conclusions are tentative, based on available data.
C. Intelligent failure is a form of success.
D. A hypothesis must be supported by the data gathered in an investigation.

80. Which of the following statements best describes the relationship of "Process Science" and "Content Science"?

A. Content Science should be taught first, then Process Science.
B. Content Science concentrates on the means, whereas Process Science is more concerned with the end product.
C. Process Science is seen as a "tool" that can be used in working with Content Science.
D. Process Science should be kept separate from Content Science.

Ron, a science teacher, set up an experiment to measure the effects of crowding on gerbils. The class found the following data from the experiment. (Questions 81-84)

NO. OF GERBILS/CAGE	WT. GAIN/GERBIL (1 MONTH)(OZ.)	MINUTES OF MOVEMENT PER HR. (AV.) GERBIL
1	5	10
2	15	20
3	12	30
4	10	28
5	6	27
6	5	29
7	4	28
8	3	29
9	2	28

81. The manipulated variable(s) was/were:

A. minutes of movement/hr./gerbil.
B. weight gain/gerbil.
C. number of gerbils/cage.,
D. weight gain and minutes of movement.
E. number of gerbils and weight gain.

82. The responding variable(s) was/were:

A. number of gerbils/cage.
B. weight gain/gerbil.
C. minutes of movement/hr./gerbil.
D. weight gain and minutes of movement.
E. number of gerbils and weight gain.

83. The generalization *best* supported by data is:

A. gerbils tend to lose weight as they become more crowded.
B. gerbils weight gain is reduced as their number increases.
C. even though crowding is not good, too many gerbils is better than too few in terms of weight gain.
D. in terms of weight gain, the best number of gerbils in a cage is 5.

84. The generalization *best* supported by data is:

A. as the number of gerbils increases their amount of activity also increases.
B. gerbils' activity tends to diminish with overcrowding.
C. gerbils' activity tends to stabilize as they become more crowded.
D. with crowding, gerbils are initially more active but as crowding increases they become less active than when they're not crowded.

85. Student cooperation is effective and desirable under all of the following *except* when:

A. problem solving is desired.
B. divergent thinking or creativity is desired.
C. the task is complex.
D. the learning goals are highly important.
E. increasing student performance on a drill activity is desired.

86. Ms. Anderson's first two science lessons were devoted to classroom procedures and behavior instead of to the science content material. This will probably result in:

A. good classroom procedure and behavior, but poor understanding of the material.
B. loss of student interest in the material.
C. rushing through the material to make up for lost classes.
D. time gained over the course of the year.

87. Which of the following is *not* an inquiry/process objective?

A. hypothesizing.
B. measuring.
C. reporting.
D. inferring.
E. comparing.

88. In evaluating "hands-on" activities, the major emphasis should be on measuring students'

A. process skill development.
B. understanding of the nature of science.
C. content acquisition.
D. all of the above.

#89, 90, 91, and 92 - - Read the paragraph and select your answer from the choices given. An answer may be used more than once or not at all.

Students are asked to drop pistachio shells into a cup of soda pop. The shells sink to the bottom for a while, then, as if by magic, they rise to the top of the cup.

Select your answers from the following:

A. Why do the bubbles appear on the shells?
B. Have you seen this chemical reaction before?
C. What do you see happening in the glass?
D. What principle is involved in this demonstration?

89. Which question best promotes a recall response?

90. Which question requires students to make an observation?

91. Which question requires students to process data?

92. Which question would be best to ask the class in an attempt to develop data-gathering responses?

Confidence Level Evaluation

This instrument is a set of 20 statements that relate to the goals of this workshop.

Please complete this section using the answer sheet provided.

Below you will find 5 statements that describe levels of confidence.

E – I feel I am thoroughly and completely competent, both in a general sense and in the related details.

D – I feel competent at a highly satisfactory level.

C – I feel competent at a satisfactory level.

B – I feel competent at a satisfactory level, and I have considerably more to learn both in a general sense and with respect to related details.

A – I feel no competency at all, either in a general sense or with respect to related details.

After you have carefully read each of the statements please mark on the answer sheet the letter corresponding to your perceived level of confidence for that statement. Mark all 20 statements.

Example:

I can chew gum and walk at the same time.

A ═══ B ═══ C ═══ D ═══ E ═══

(The person who marked this example is very confident to do this task.)

93. Being able to use the following inquiry/process skills: observing, classifying, communicating, measuring, inferring, predicting, relating objects and events to other objects and events, defining operationally and investigating.

A B C D E

94. Being able to plan learning activities for children which emphasize the development of inquiry/process skills.

A B C D E

95. Being able to utilize ideas and activities from textbooks for a "hands-on" approach to science.

A B C D E

96. Being able to identify and explain how an existing science program can be modified to meet specific classroom needs.

A B C D E

97. Being able to identify and distinguish among essential elements involved in teaching-learning activities.

A B C D E

98. Being able to define and identify the following instructional techniques:
a. motivation/introduction,
b. data-gathering,
c. data-processing,
d. closure.

A B C D E

99. Being able to identify and utilize specific motivation/introduction techniques to gain students' attention and relate to their past experiences.

A B C D E

100. Being able to identify and utilize data-gathering techniques to create a common base of experience related to the instructional objectives of a science lesson.

A B C D E

101. Being able to identify and utilize specific data-processing techniques to encourage pupils to form a new concept, principle, or skill in a new situation.

A B C D E

102. Being able to identify and utilize specific closure techniques to review and summarize a science lesson so that the important points are high-lighted and students can be given a chance to demonstrate their understanding.

A B C D E

103. Being able to select a science topic and construct a teaching strategy which includes instructional objectives, behavioral indications, techniques or methods to be utilized, and evaluations to be employed.

A B C D E

104. Being able to identify and appropriate topic for a unit of instruction in science.

A B C D E

105. Being able to ask questions about science topics which would encourage students to respond in the following ways: recall, gather data, process data, and evaluate.

A B C D E

106. Being able to select a science topic and construct an appropriate questioning strategy as part of a planned science activity.

A B C D E

107. Being able to describe/utilize appropriate ways of meeting the special educational needs of students with physical, social and/or intellectual differences.

A B C D E

108. Being able to identify and construct classroom arrangements that are appropriate for cooperative, competitive and individualized goal structures.

A B C D E

109. Being able to identify/utilize common usage metric units.

A B C D E

110. Being able to estimate, in appropriate metric units, the linear dimensions of a given object.

A B C D E

111. Being able to devise an investigation and carry it out.

A B C D E

112. Being able to teach science in all grades.

A B C D E

Appendix C

CO-OP DIRECTOR SURVEY INSTRUMENT

SCIENCE TRAINING EVALUATION

Co-op: _____ Director: _____

This evaluation is being conducted to determine your impression of the effectiveness of SAVI-SELPH training, to gather data for the final report, and to determine your needs for possible follow-up activities in 1988-89. Please complete the questionnaire and return it to Jamie Morris by May 31, 1988. Thanks for your help.

1. How effective has the training been in helping your teachers meet the 40% lab requirements and the science essential elements?

   1 2 3 4 5
   Not Effective Very Effective

2. Describe briefly how your teachers are using the SAVI-SELPH science kits (e.g.: Is there evidence of use or are they not being used?):

3. What changes have you seen in your teachers' attitudes toward teaching science as a result of the training?

4. Are your handicapped students receiving more science instruction, less science instruction, or about the same amount of science instruction as before the training?

   More _____ Less _____ About the Same _____

5. What kind of follow-up would you like to have next year? How often?
   (Check all that apply and indicate frequency.)

   a. on-site technical assistance _____ how often _____

   b. workshops at Region VIII _____ how often _____

   c. workshops within your co-op _____ how often _____

   d. other _____

6. Please make any additional comments regarding the science training.

Appendix D

COURSE EVALUATION FORM

STUDENT DESCRIPTION OF TEACHER AND COURSE

(Alternative Form for Student-Teaching and Practicum)

Instructor_____ Course_____
Prefix Number Section Number

Semester_____ Year_____ CHECK ONE: Elective in Major_____

Elective_____ University Requirement _____ Major Requirement _____

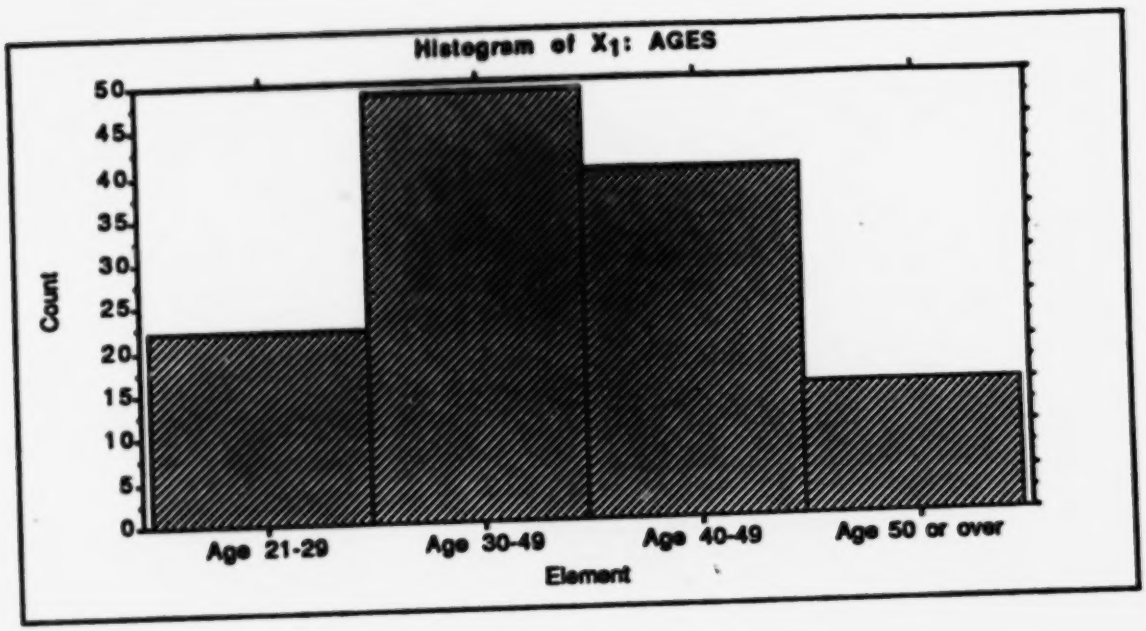
The following items reflect some ways courses/instructors can be described. On the items below, please circle the number which indicates the degree to which you think the item is descriptive of this course/instructor. Please make specific comments on the back of this form.

	Very Descriptive						Not At All Descriptive	Doesn't Apply
1. The student guide or syllabus was clear, easily understood, and identified student requirements and responsibilities.	7	6	5	4	3	2	1	( )
2. The instructor scheduled sufficient office hours to meet with students regarding the course.	7	6	5	4	3	2	1	( )
3. The instructor was willing to help students as they required assistance.	7	6	5	4	3	2	1	( )
4. The instructor was accepted by pupils and supervising teacher.	7	6	5	4	3	2	1	( )
5. Individualized (or group) meetings with the instructor were of significant value.	7	6	5	4	3	2	1	( )
6. The instructor ascertained that my supervising teacher provided me with adequate coaching and conferences.	7	6	5	4	3	2	1	( )
7. The instructor provided me with positive criticisms as soon as possible after observing lessons or activities.	7	6	5	4	3	2	1	( )
8. Circle the number of times the instructor made a supervisory visit.	7	6	5	4	3	2	1	( )

	Among the Very Best						Among the Very Worst	Don't Know
9. All things considered, how does this course compare with other courses you have had at this school?	7	6	5	4	3	2	1	( )
10. How does the instructor compare with other instructors at this school?	7	6	5	4	3	2	1	( )

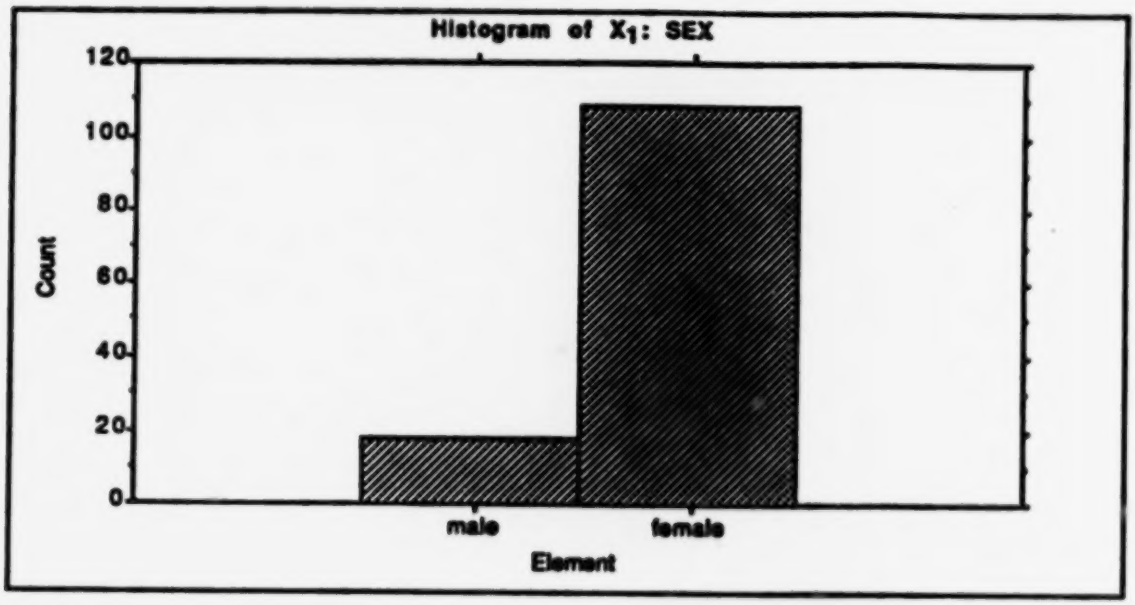
Appendix E

BIOGRAPHICAL AND BACKGROUND SURVEY DATA



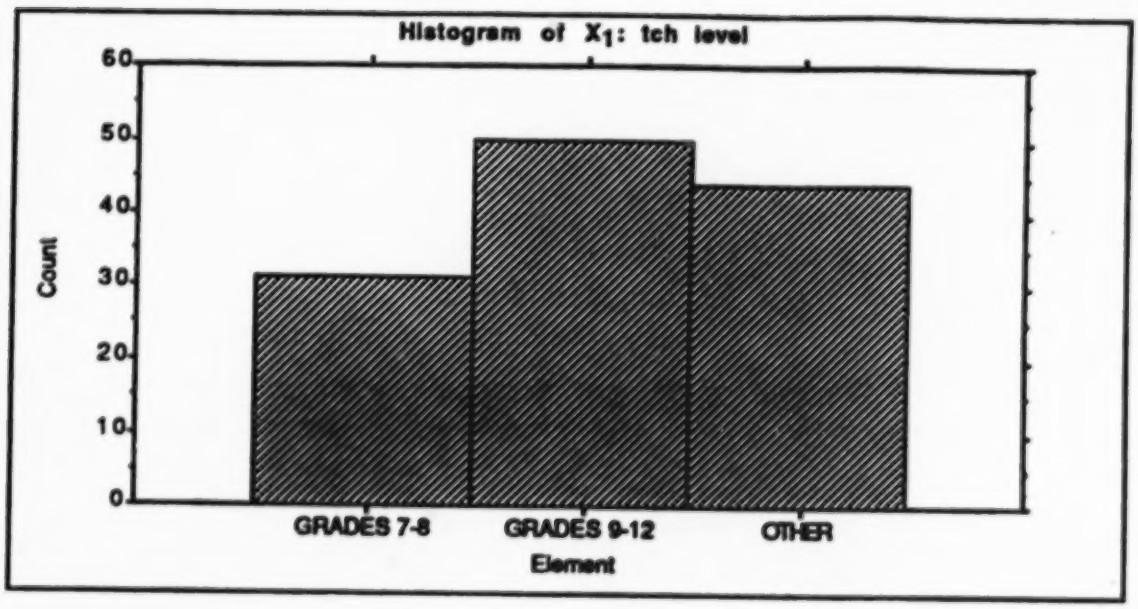
X_1: AGES

Bar:	Element:	Count:	Percent:	
1	Age 21-29	22	17.46	
2	Age 30-49	49	38.889	-Mode
3	Age 40-49	40	31.746	
4	Age 50 or over	15	11.905	



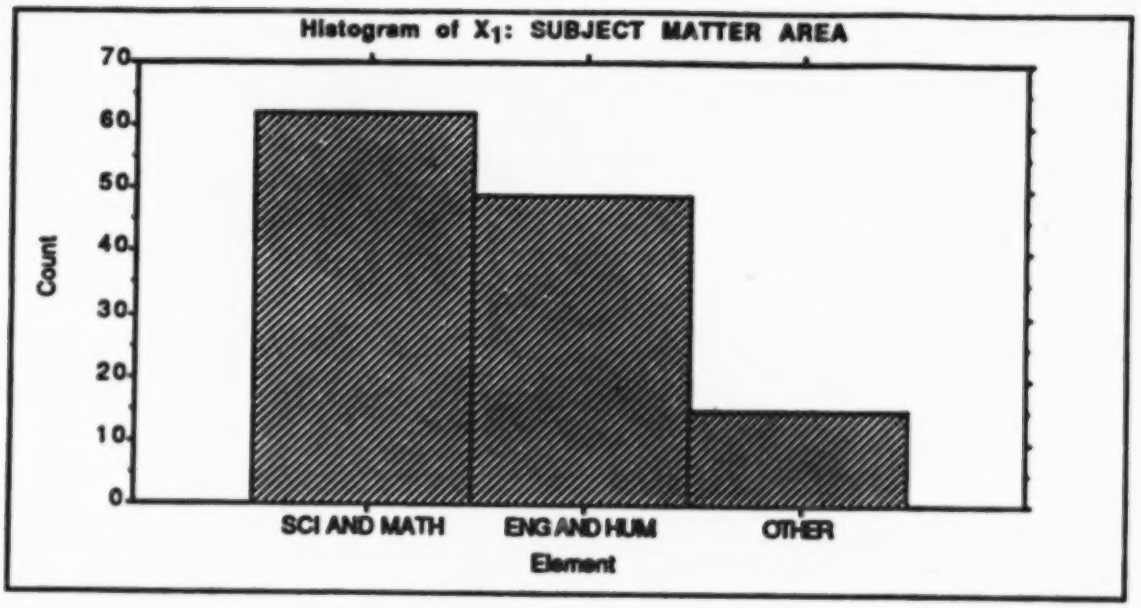
X_1: SEX

Bar:	Element:	Count:	Percent:	
1	male	16	14.286	
2	female	108	85.714	-Mode



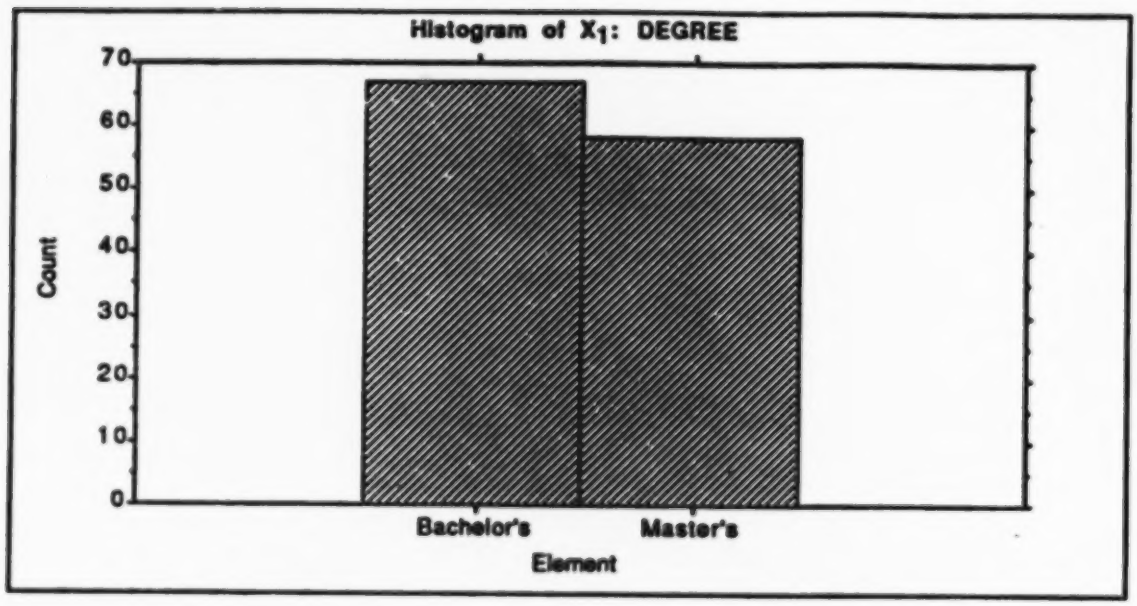
X_1: tch level

Bar:	Element:	Count:	Percent:	
1	GRADES 7-8	31	24.8	
2	GRADES 9-12	50	40	-Mode
3	OTHER	44	35.2	



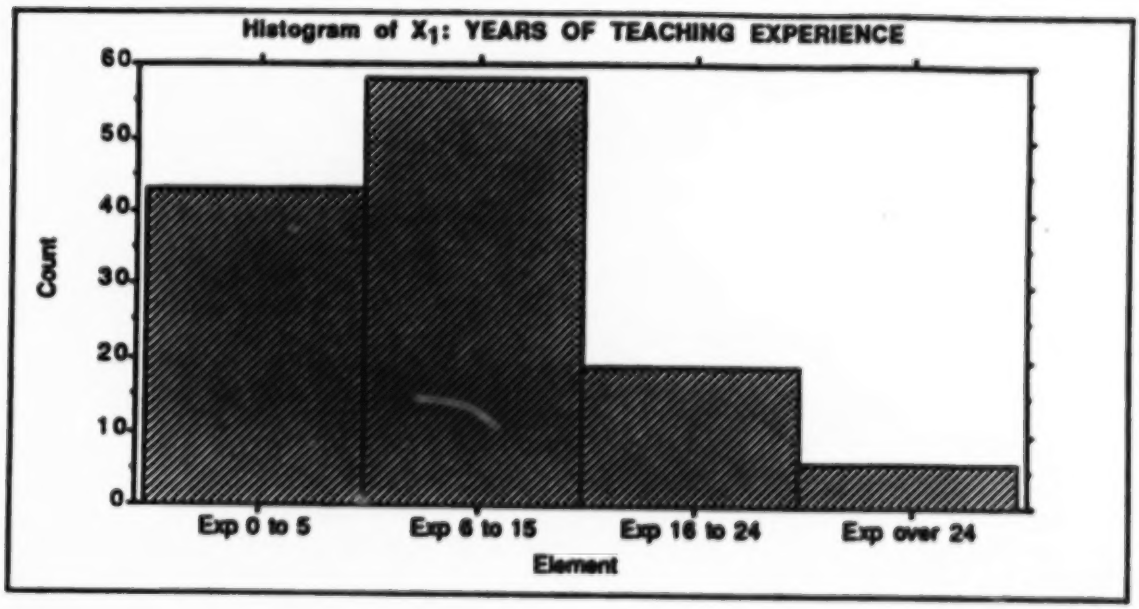
X_1: SUBJECT MATTER AREA

Bar:	Element:	Count:	Percent:	
1	SCI AND MATH	62	49.206	-Mode
2	ENG AND HUM	49	38.889	
3	OTHER	15	11.905	



X_1: DEGREE

Bar:	Element:	Count:	Percent:	
1	Bachelor's	67	53.6	-Mode
2	Master's	58	46.4	



X_1: YEARS OF TEACHING EXPERIENCE

Bar:	Element:	Count:	Percent:	
1	Exp 0 to 5	43	34.127	
2	Exp 6 to 15	58	46.032	-Mode
3	Exp 16 to 24	19	15.079	
4	Exp over 24	6	4.762	

Appendix F

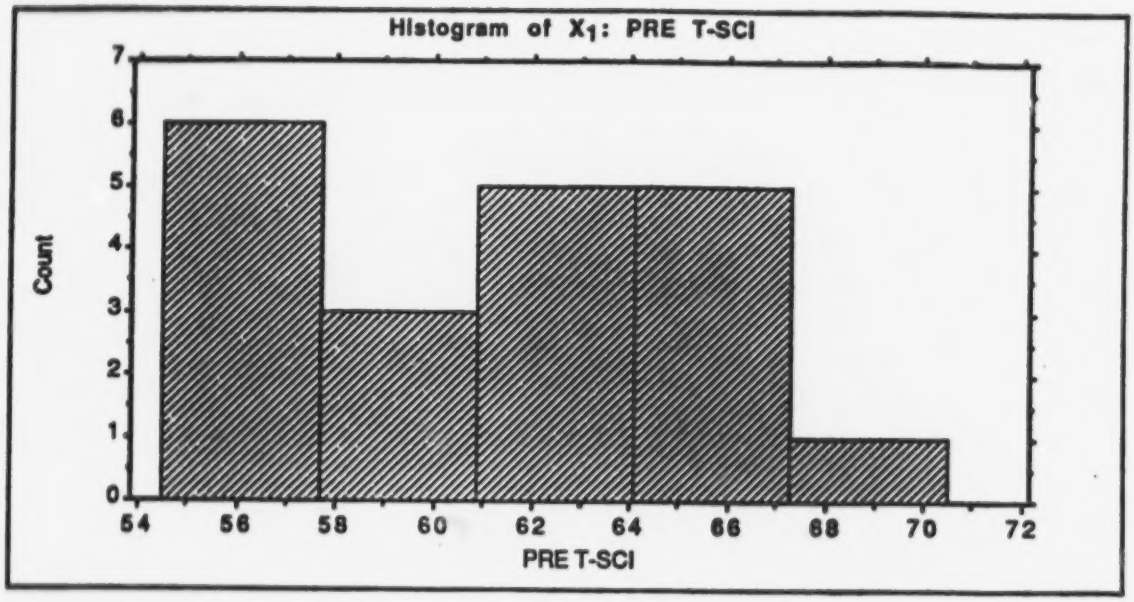
COMPARISON OF PRE AND POST ATTITUDE SCORES TOWARD SCIENCE AND SCIENCE TEACHING

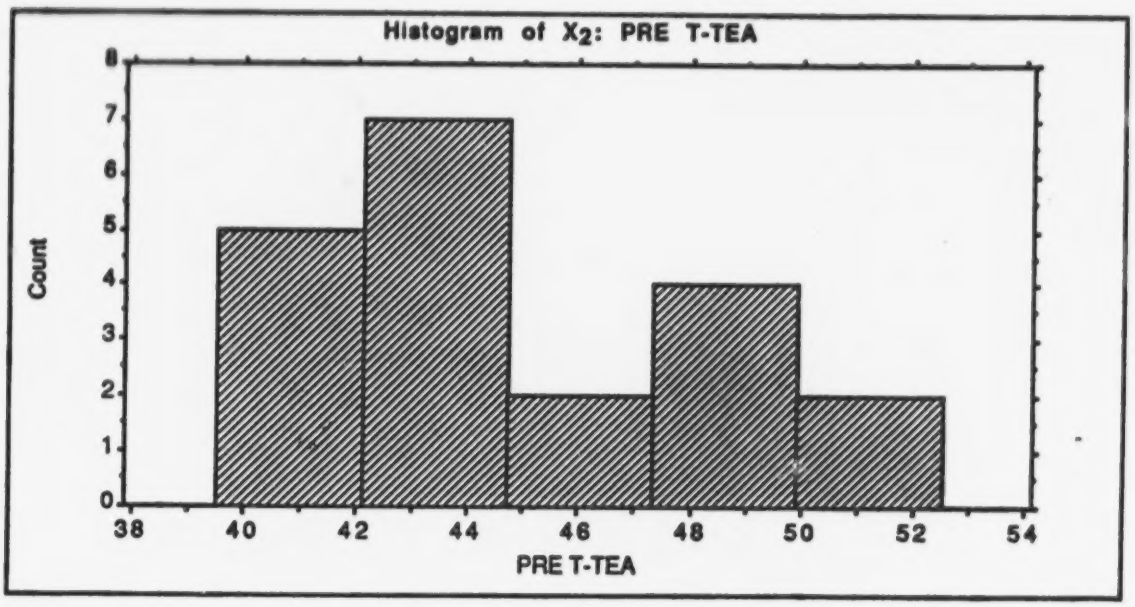
Paired t-Test X_1: POST T-SCI Y_1: PRE T-SCI

DF:	Mean X - Y:	Paired t value:	Prob. (1-tail):
19	3.175	2.404	.0133

Paired t-Test X_1: POST T-TEA Y_1: PRE T-TEA

DF:	Mean X - Y:	Paired t value:	Prob. (1-tail):
19	2.85	3.875	.0005


Histogram of X1: PRE T-SCI
Count
0
1
2
3
4
5
6
7
54
56
58
60
62
64
66
68
70
72
PRE T-SCI


Histogram of X2: PRE T-TEA
Count
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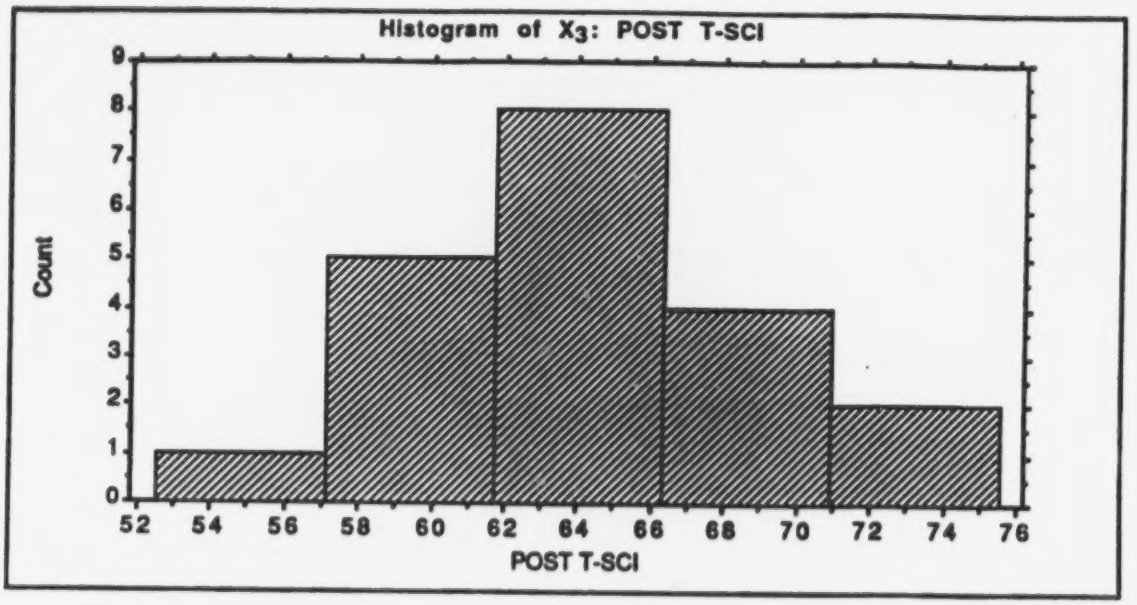
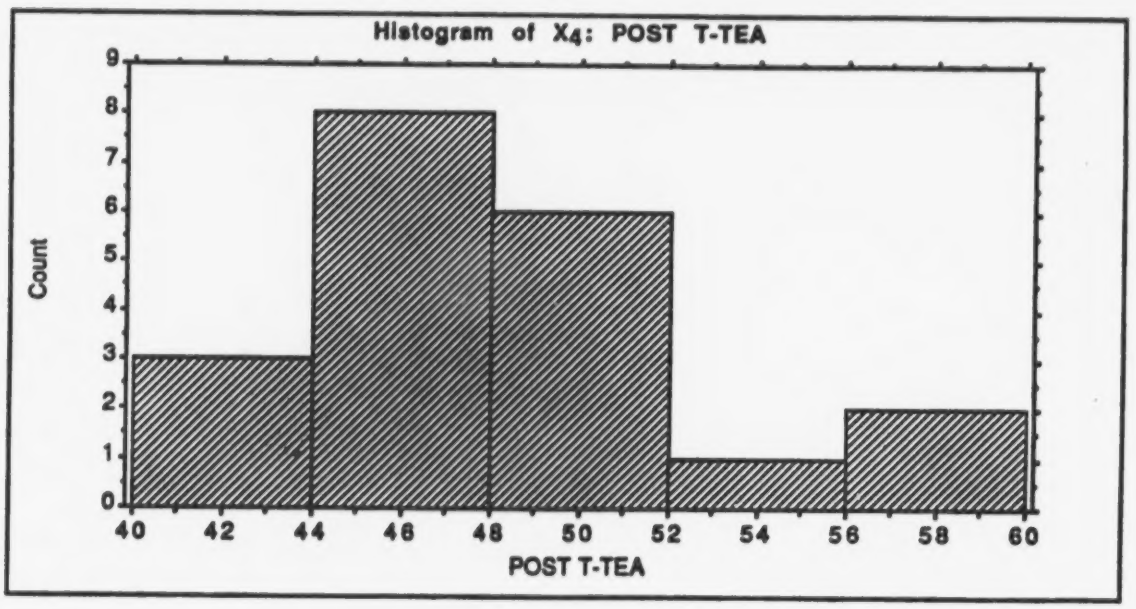
1
2
3
4
5
6
7
8
38
40
42
44
46
48
50
52
54
PRE T-TEA


Histogram of X3: POST T-SCI
Count
0
1
2
3
4
5
6
7
8
9
52
54
56
58
60
62
64
66
68
70
72
74
76
POST T-SCI


Histogram of X4: POST T-TEA
Count
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1
2
3
4
5
6
7
8
9
40
42
44
46
48
50
52
54
56
58
60
POST T-TEA

X_1: PRE T-SCI

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
60.975	4.775	1.068	22.802	7.831	20
Minimum:	**Maximum:**	**Range:**	**Sum:**	**Sum Squared:**	**# Missing:**
54.5	69.5	15	1219.5	74792.25	0

1

X_2: PRE T-TEA

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
44.975	3.238	.724	10.486	7.2	20
Minimum:	**Maximum:**	**Range:**	**Sum:**	**Sum Squared:**	**# Missing:**
39.5	51.5	12	899.5	40654.25	0

2

X_3: POST T-SCI

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
64.15	4.934	1.103	24.345	7.691	20
Minimum:	**Maximum:**	**Range:**	**Sum:**	**Sum Squared:**	**# Missing:**
52.5	74.5	22	1283	82767	0

3

X_4: POST T-TEA

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
47.825	4.702	1.051	22.112	9.832	20
Minimum:	**Maximum:**	**Range:**	**Sum:**	**Sum Squared:**	**# Missing:**
40	59	19	956.5	46164.75	0

4

Appendix G

COMPARISON OF PRE AND POST KNOWLEDGE TEST SCORES

Paired t-Test X 1 : POST COGN Y 1 : PRE COGN

DF:	Mean X - Y:	Paired t value:	Prob. (1-tail):
19	3.65	4.442	.0002

X_1: PRE COGN

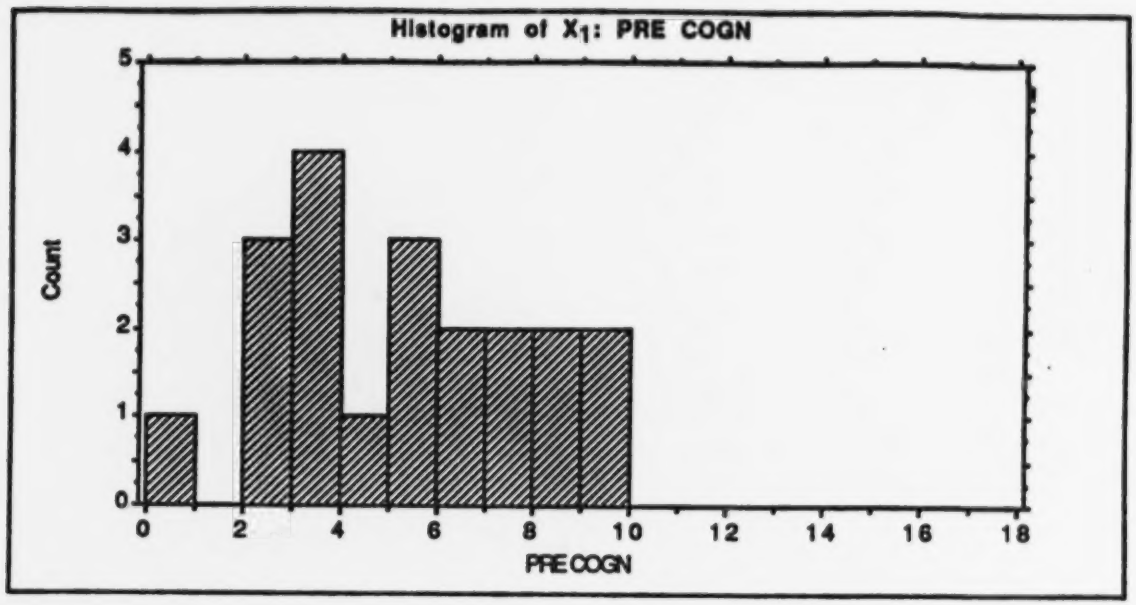
Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
4.85	2.601	.582	6.766	53.631	20
Minimum:	**Maximum:**	**Range:**	**Sum:**	**Sum Squared:**	**# Missing:**
0	9	9	97	599	0

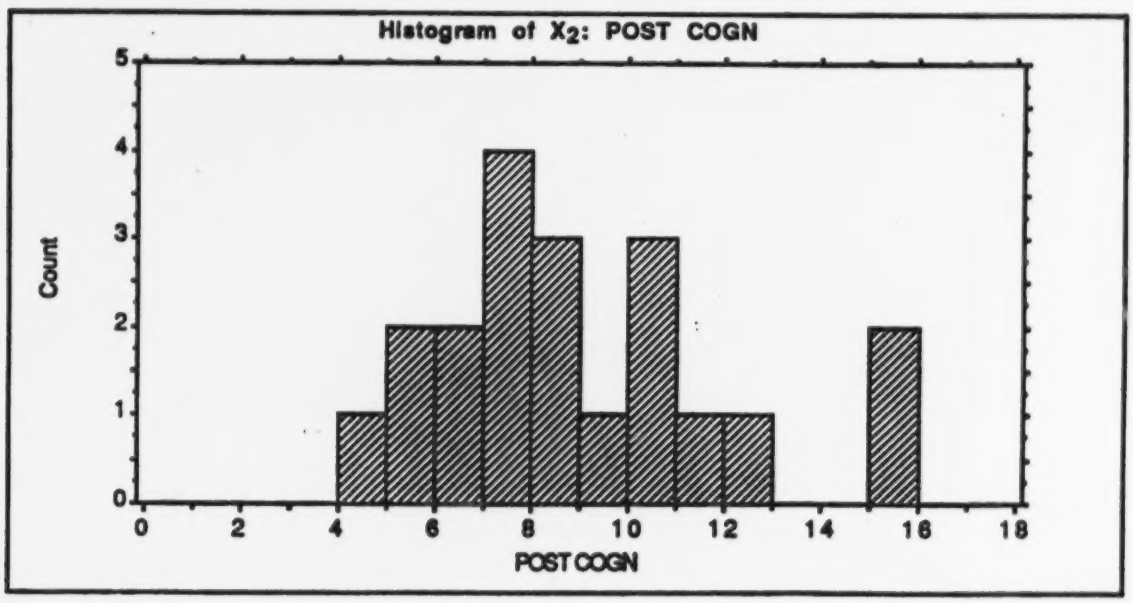
1

X_2: POST COGN

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
8.5	3.052	.682	9.316	35.908	20
Minimum:	**Maximum:**	**Range:**	**Sum:**	**Sum Squared:**	**# Missing:**
4	15	11	170	1622	0

2


Histogram of X1: PRE COGN
Count
0
1
2
3
4
5
0
2
4
6
8
10
12
14
16
18
PRE COGN


Histogram of X2: POST COGN
Count
0
1
2
3
4
5
0
2
4
6
8
10
12
14
16
18
POST COGN

Appendix H

COMPARISON OF PRE AND POST CONFIDENCE LEVELS

Paired t-Test X_1: POST Y_1: PRE

DF:	Mean X - Y:	Paired t value:	Prob. (1-tail):
19	.708	23.65	.0001

X_1: PRE

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
2.474	.264	.059	.07	10.685	20
Minimum:	**Maximum:**	**Range:**	**Sum:**	**Sum Squared:**	**# Missing:**
1.85	2.83	.98	49.48	123.741	0

1

X_2: POST

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
3.182	.32	.071	.102	10.046	20
Minimum:	**Maximum:**	**Range:**	**Sum:**	**Sum Squared:**	**# Missing:**
2.28	3.54	1.26	63.635	204.412	0

2

1	3.16	2.21
2	3.11	2.47
3	3.42	2.83
4	3.09	2.45
5	3.38	2.59
6	3.38	2.47
7	3.54	2.73
8	3.19	2.33
9	3.33	2.45
10	3.38	2.59
11	3.21	2.52
12	3.38	2.61
13	3.28	2.61
14	3.40	2.73
15	3.38	2.80
16	3.21	2.54
17	2.28	1.85
18	2.40	1.85
19	3.00	2.33
20	3.11	2.52